The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte DAVID J. EDLUND, ARNE LAVEN, WILLIAM A. PLEDGER, and CURTISS RENN

Appeal 2007-0492
Application 10/810,960[1]
Technology Center 1700

Decided: April 16, 2007

Before: RICHARD E. SCHAFER, ROMULO H. DELMENDO, and MARK NAGUMO, Administrative Patent Judges.

NAGUMO, Administrative Patent Judge.

DECISION ON APPEAL

A. Statement of the Case

Appellants appeal under 35 U.S.C. § 134 from the final rejection of claims 1–3, 6–10, 13, 16, 19, 20, 27–29, 31, 33–36, and 44–68 as obvious under 35 U.S.C. § 103(a) over various references. We have jurisdiction under 35 U.S.C. § 6(b). For the reasons that follow, we affirm.

[1] Application for patent filed 25 March 2004. The real party in interest is identified as IdaTech, LLC.

BACKGROUND

Fuel cells operate by bringing a fuel, such as hydrogen gas, to the anode region of the fuel cell, and an oxidizing agent, such as oxygen gas, to the cathode region of the fuel cell. (10/810,960 specification (hereafter, "Specification") at 1.) The anode and the cathode regions are separated physically by an ion-permeable but electrically insulating membrane that permits protons (derived from the hydrogen gas) to pass, but not the hydrogen molecules. (*Id.* at 10.) The specification further explains that an external circuit connecting the anode region to the cathode region provides the lowest energy path for electrons (the membrane being an insulator). (*Id.)* According to the specification, in the cathodic region, protons, electrons, and oxygen combine in electrochemical reactions to form water. (*Id.*) If an electrically operated device (e.g., a light bulb or motor) forms part of the external electrical circuit, useful work is done along with the electrochemical reactions. (*Id.* at 11.)

According to Appellants, a conventional source of oxygen for fuel cells is air, which is about 20–21% oxygen by volume. (Specification at 13.) According to Appellants, among the benefits of higher oxygen concentration in the cathodic region are an increase in power density, easier recovery of the by-product water from the cell, and more efficient operation of the fuel cell due to fewer impurities in the oxygen stream. (*Id.* at 16–17.) Appellants further state that conventional methods of increasing the amount of oxygen to the cathode region of the fuel cell include fans and compressors. (*Id.* at 12.)

According to Appellants, an aspect of their invention is the use of an "oxygen-enrichment assembly" — in a particularly preferred embodiment, an oxygen permeable membrane — to provide a stream of oxygen-enriched gas to the cathode region of the fuel cell. (*Id.* at 13–14.) The oxygen-enrichment assembly produces, as a byproduct, a second stream of gas that is depleted in oxygen. (*Id.* at 14, ll. 11-15.)

According to Appellants, conventional sources of hydrogen for fuel cells include carbon-containing liquids and water, which are conventionally converted to hydrogen in a "fuel processor" that can be part of the overall fuel cell system. (Specification at 12.) Appellants further present, as an aspect of their invention, the use of the byproduct low-oxygen stream to "pressurize" the liquid fuel. (*Id.* at 14, ll. 16ff; see also independent claim 61 and dependent claims 45 and 48.)

In this appeal, Appellants have challenged the adequacy of the Examiner's rejection of claimed subject matter based on these two features — the incorporation of an oxygen enrichment assembly (all claims), in particular, an oxygen-selective membrane (independent claims 1 and 27), and the use of the low-oxygen stream from that assembly to pressurize liquid fuel (dependent claims 45 and 48, and independent claim 61).

Claims 1 and 61 are representative.

Claim 1 reads:

A fuel cell system, comprising:

[a] a fuel processing assembly adapted to produce a product hydrogen stream containing at least substantially pure hydrogen gas from at least one feed stream that comprises at least a carbon-containing feedstock;

[b] an air delivery system adapted to receive an air stream having a concentration of oxygen gas and to produce therefrom an oxygen-enriched

stream having a greater concentration of oxygen gas than the air stream, wherein the air delivery system includes at least one oxygen-enrichment assembly adapted to produce the oxygen-enriched stream from the air stream, and further wherein the oxygen-enrichment assembly includes at least one oxygen-selective membrane;

[c] a fuel cell stack adapted to receive at least a portion of the product hydrogen stream and the oxygen-enriched stream and to produce an electric current therefrom; wherein the fuel cell stack is adapted to emit a cathode exhaust stream containing water; and

[d] a water recovery assembly adapted to receive the cathode exhaust stream and to produce a product water stream therefrom.

(Brief, Claim Appendix at 1; paragraph labels and emphasis added to highlight the disputed limitations.)

Claim 61 reads:

A fuel cell system, comprising:

[a] a fuel processing assembly adapted to produce a product hydrogen stream containing at least substantially pure hydrogen gas from at least one feed stream that comprises at least a carbon-containing feedstock;

[b] an air delivery system adapted to receive an air stream having a concentration of oxygen gas and to produce therefrom an oxygen-enriched stream having a greater concentration of oxygen gas than the air stream and a byproduct stream having a lower concentration of oxygen gas than the air stream, wherein the air delivery system includes at least one oxygen-enrichment assembly adapted to produce the oxygen-enriched stream from the air stream, and further wherein the byproduct stream is used to pressurize the supply of liquid fuel;

[c] a fuel cell stack adapted to receive at least a portion of the product hydrogen stream and the oxygen-enriched stream and to produce an electric current therefrom; wherein the fuel cell stack is adapted to emit a cathode exhaust stream containing water; and

[d] a water recovery assembly adapted to receive the cathode exhaust stream and to produce a product water stream therefrom.

(Brief, Claim Appendix at 8–9; paragraph labels and emphasis added to highlight the disputed limitations.)

Claim 61 differs from claim 1 in that claim 61 recites the presence of the byproduct low-oxygen content stream and the use of that stream to pressurize the liquid fuel; and in the absence of requiring the oxygen-enrichment assembly to include at least one oxygen-selective membrane.

Independent claim 27 covers a process and resembles claim 1 in the recitation of an oxygen-selective membrane; and it resembles claim 61 in the recitation of the low oxygen-content byproduct stream; but it does not require any further use of the byproduct stream.

Independent claim 50 covers a fuel cell system resembling the one covered by claim 61 but not requiring a low oxygen-content byproduct stream or its use to pressurize a liquid fuel.

Claim 45 depends from claim 1, and adds the limitations of a low oxygen-content byproduct stream and its use to pressurize a liquid fuel. Claim 48 depends from claim 27, and adds the limitations of a low oxygen-content byproduct stream and its use to pressurize a liquid fuel.

B. Issues

1. Have Appellants demonstrated that the combination of the fuel cell system disclosed by Okamoto and the membrane-based enrichment of oxygen suggested by St-Pierre for use in fuel cells would create an inoperable device and is therefore improper?

2. Have Appellants shown that Ito does not disclose pressuring a supply of fuel with the oxygen depleted stream from an oxygen-enrichment assembly?

C. Findings of Fact

The following findings of fact, as well as any others set out in this opinion are supported by a preponderance of the evidence of record.

1. Appellants have appealed the rejection of claims 1–3, 6–10, 13, 16, 19, 20, 27–29, 31, 33–36[2], and 44–68, which are all the pending claims of the 10/810,960 application. (Appeal Brief filed 27 April 2006 ("Brief") at 2, 2d full paragraph.)

THE PRIOR ART

2. The Examiner relies on the following prior art in the rejections of the claimed subject matter on appeal:

St-Pierre et al.	U.S. 6,627,338 B2	30 Sept 2003
Appleby et al.	U.S. 2001/0026884	4 Oct 2001
Okamoto	U.S. 6,045,933	4 April 2000
Blomen et al.	Fuel Cell Systems	1993
Ito	U.S. 4,509,915	9 April 1985

(Examiner's Answer mailed 13 July 2006 ("Answer") at 2.)

[2] We do not find claim 36 listed in the statements of rejection in the Final Rejection, but because the Appellants agree that it has been rejected, we accept the Examiner's and Appellants' representations and assume that the discrepancy will be addressed in any further prosecution, if necessary.

THE REJECTIONS

3. The Examiner maintains the following rejections[3]:

a. Claims 1–3, 6, 7–10, 20, 27–29, 31, 33–35, 44, and 47 are rejected under 35 U.S.C. § 103(a) over the combined teachings of Okamoto and St-Pierre. (Answer at 2, incorporating the Final Rejection, mailed 9 June 2005 ("Final Rejection") 2–3, ¶ 4, and 4, ¶ 5.)

b. Claims 13, 16, 50–58, and 60 are rejected under 35 U.S.C. § 103(a) over the combined teachings of Okamoto, St-Pierre, and Fuel Cell Systems. (Answer at 2, incorporating Final Rejection 4–5, ¶ 6, 7–9, ¶ 9, and 9–10, ¶ 10.)

c. Claims 45, 46, 48, 49, 61–66, and 68 are rejected under 35 U.S.C. § 103(a) as being obvious over the combined teachings of Okamoto, St-Pierre, and Ito. (Answer at 2, incorporating Final Rejection 6–7, ¶ 8, 10–12, ¶ 12.)

d. Claim 19 is rejected under 35 U.S.C. § 103(a) over the combined teachings of Okamoto, St-Pierre, and Appleby. (Answer at 2, incorporating Final Rejection 5–6, ¶ 7.)

e. Claim 59 is rejected under 35 U.S.C. § 103(a) over the combined teachings of Okamoto, St-Pierre, Fuel Cell Systems, and Appleby. (Answer at 2, incorporating Final Rejection 10, ¶ 11.)

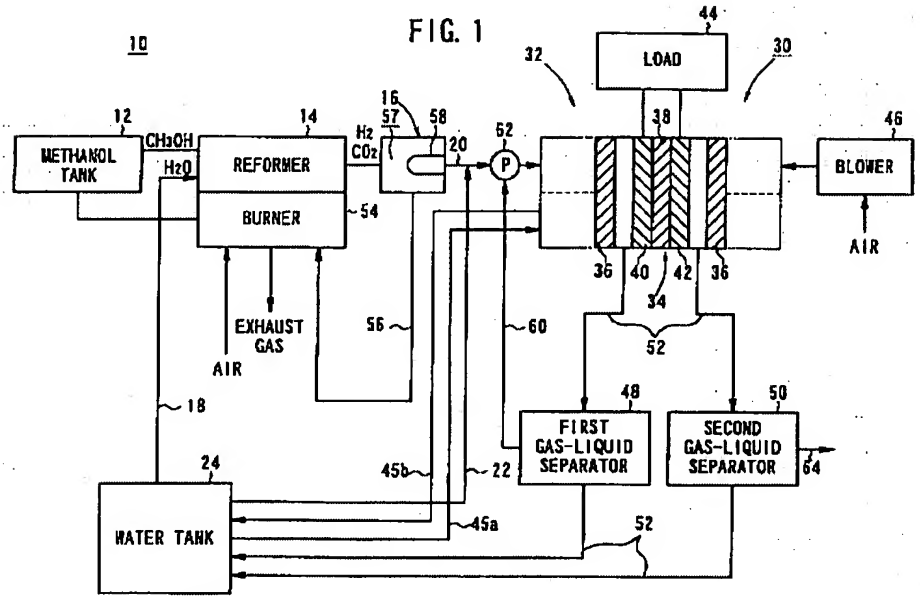
f. Claim 67 is rejected under 35 U.S.C. § 103(a) over the combined teachings of Okamoto, St-Pierre, Ito, and Appleby. (Answer at 2, incorporating Final Rejection 13, ¶ 13.)

[3] Due to the posture of this appeal, we have combined the nominally separate rejections of various claims over the same prior art references.

The Prior Art: Okamoto

4. With reference to Figure 1, reproduced here,

FIG. 1



Okamoto discloses a fuel cell system comprising:

(a) a fuel gas supply device **10** comprising a methanol tank **12** that delivers methanol to a reformer **14** (Okamoto at col. 2, ll. 45–51), which in turn delivers hydrogen to a hydrogen gas supply **16**, which comprises a hydrogen selective permeable membrane **58**, which selectively allows penetration of hydrogen gas only (*id.* at col. 3, 24-28). The hydrogen gas is then directed through conduit **20** to the hydrogen electrode **40** (anode) side of fuel cell **30**. (*Id.* at col. 2, 59-67.) A water tank **24** provides water to the reformer 14 and to the hydrogen gas directed at the anode via conduit **22.** (*Id.* at col. 2, ll. 55–60);

(b) an air delivery system comprising a blower **46**, which directs air to the air electrode **30** (cathode) of the fuel cell;

(c) a recovery system in which exhausts from the hydrogen and oxygen sides of the fuel cell are passed through gas-liquid separators **48** and **50**, and recovered water is sent to water tank **24** via pipes **52**.

5. Okamoto does not disclose an oxygen-enrichment assembly as required by Appellants' claims.

The Prior Art: St-Pierre

6. St-Pierre discloses as its invention methods and systems for enriching reactants for fuel cells via an "integrated pressure swing adsorption apparatus" ("PSA"). (St-Pierre at col. 3, ll. 46–48.)

7. According to St-Pierre, "[o]xygen is typically obtained from the air surrounding the fuel cell system. However, non-reactive nitrogen then typically becomes the major component in the dilute oxidant stream." (St-Pierre at col. 2, ll. 51–54.)

8. St-Pierre states further:

> [i]ncreasing the concentration of the reactant in reformed fuel and/or air streams, that is, enrichment, has thus been considered in the art as a way of improving fuel cell performance. Several enrichment methods are commonly known that involve separating out a component from the reactant stream, including cryogenic, membrane, and pressure swing adsorption methods. . . . In a membrane method, component separation is achieved by passing the stream over the surface of a membrane that is selectively permeable to a component in the stream.

(St-Pierre at col. 2, ll. 55–66; emphasis added.)

The Prior Art: Ito

9. Ito discloses a combustion apparatus for burning liquid fuels.

10. With reference to Figures 3 and 4, reproduced here,

Fig. 3

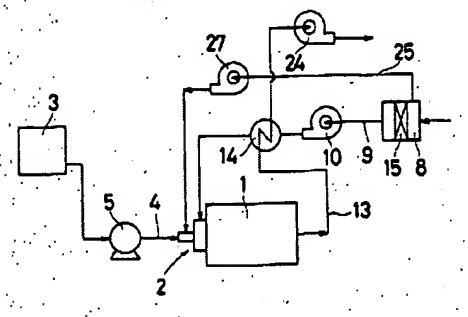
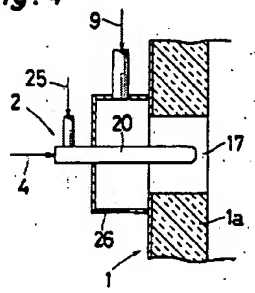


Fig. 4



Ito describes a combustion apparatus comprising an oxygen-enriched air generating means **8** that in embodiments comprises an oxygen selective membrane **15**. (Ito at col. 3, l. 44, through col. 4, l. 36.)

11. Ito shows that oxygen enriched air is directed via conduit **9** to the windbox **26**, providing the primary combustion air. (Ito at col. 4, ll. 6–10, 20–21.)

12. Ito shows a conduit **25** delivering nitrogen-enriched air from the enriched air generating means **8** to a fuel spraying cylinder **20** that is also fed fuel via fuel supply pipe 4. (Ito at col. 4, ll. 11–19.)

13. In Ito's words, "liquid fuel is jetted from the fuel spraying cylinder **20** as it is atomized by nitrogen-enriched air." (Ito at col. 4, ll. 22–24.)

14. According to Ito, using the oxygen-rich, nitrogen-poor primary air and the nitrogen-rich, oxygen-poor secondary air in this manner results in efficient combustion and reduced NO_x emission from the burner. (Ito at col. 2, ll. 3–7.)

Rejections based on Okamoto and St-Pierre

15. The Examiner finally rejected independent claims 1 and 27 over the combined teachings of Okamoto and St-Pierre. (Final Rejection at 2, ¶ 4.)

16. The Examiner finally rejected independent claim 50 over the combined teachings of Okamoto, St-Pierre, and Fuel Cell Systems. (Final Rejection at 7ff, ¶ 9 and at 9ff, ¶ 10.)

17. The Examiner finally rejected independent claim 61 over the combined teachings of Okamoto, St-Pierre, and Ito. (Final Rejection at 6–7, ¶ 8, and 10–12, ¶ 12.)

18. The Examiner finally rejected all dependent claims over the combined teachings of Okamoto and St. Pierre, either alone or in combination with the additional references cited *supra*.

19. In particular, the Examiner finally rejected dependent claims 45, 48, and 61 over the combined teachings of Okamoto, St-Pierre, and Ito. (Answer at 2, Final Rejection at 6–7, ¶ 8, 10–12, ¶ 12.)

20. On appeal, Appellants argue that the Examiner's reliance on the combined teachings of Okamoto and St-Pierre is unsound because the combination of these two references would yield an inoperable device. (Answer at 6–7.)

21. Accordingly, Appellants urge that the rejections of the independent claims, i.e., claims 1, 27, 50, and 61, should be reversed, because the allegedly inoperable device resulting from the combination of Okamoto and St-Pierre is evidence that these references teach away from the claimed subject matter. (Brief at 6 and at 11.)

22. For the same reason, Appellants argue that the rejection of claims dependent from claim 1, namely claims 2, 3, 6–10, 19, 20, and 44–49, and also the claims dependent from claim 27, namely claims 28, 29, 31, and 33–36, that rely on the combined teachings of Okamoto and St-Pierre, should be reversed. (Brief at 10.)

23. Appellants argue further that the Examiner did not address dependent claims 2, 7-10, 20, 28, 29, 31, 33–35, 44, and 47 in the Final Rejection, and that consequently, the Examiner failed to establish a prima facie case of obviousness of these claims. (Brief at 10–11.)

24. The Examiner responds that the final rejection did address all limitations, citing Okamoto's teaching that hydrogen gas can be obtained from a feedstream comprising a carbon containing feedstock (methanol) and water [Okamoto at col. 2, ll. 48–57], to meet the further limitation of claim 2; citing the steam reformer to meet the further limitation recited in claim 7 [Okamoto at col. 2, l. 50]; the provision of a hydrogen selective permeable membrane PSA to remove impurities from the hydrogen gas produced by the fuel processor [Okamoto at col. 3, ll. 24–32; col. 4, ll. 47-53, respectively] to meet the further limitation of claim 8; and enrichment of the oxygen stream by removing nitrogen

to meet the further limitation of claim 9 [St-Pierre at col. 2, ll. 30–66, especially 51–66]. (Answer at 4-5, ¶ C.)

25. The Examiner further states that "claims 10, 20, 28, 29, 31, 33-35, 44 and 47 [are] all also addressed by the final rejection." (Answer at 5, ¶ C.)

26. Appellants, in their Reply Brief filed 18 August 2006 ("Reply"), do not dispute the Examiner's findings with regard to the teachings of Okamoto or the adequacy of the Examiner's rejections in this regard.

27. With regard to the claims depending from independent claims 50 and 61, namely, claims 51–60 and 62–68, respectively, Appellants urge that the failure of the prima facie case of obviousness applies equally to these claims, and that the Examiner's rejections should be reversed. (Brief at 13.)

28. Substantively, Appellants assert that Okamoto discloses exposing the cathodic region of a fuel cell to atmospheric oxygen only with a "blower **46** for introducing atmospheric air." (Brief at 8, bold original.)

29. Appellants conclude that "Okamoto is specifically directed to low-pressure, low complexity air delivery systems that merely require a blower to transport air from proximate the fuel cell stack to the cathode region of the fuel cell." (Brief at 10.)

30. According to Appellants, St-Pierre only incidentally mentions enriching the oxygen content of air using an oxygen-selective membrane system. (Brief at 9.)

31. Appellants assert that such membranes are used in a pressure-driven separation process "at a pressure greater than atmospheric pressure, such as a pressure of at least 2 bara [bar absolute]." (Brief at 9, citing the Specification at 14, ll. 8–9.)

32. Appellants conclude that "the proposed combination would be inoperable to achieve the at least 2 bara pressure required for the pressure-driven separation process used in conjunction with an oxygen-selective membrane." (Brief at 9–10.)

33. With the exception of claims 45 and 48, which are discussed post, together with claim 61, Appellants raise no other arguments about the separate patentability of any dependent claims.

34. In particular, Appellants do not argue that the limitations of any of the dependent claims would render the subject matter of the dependent claims patentable in the event that the independent claims were obvious over the combined teachings of Okamoto and St-Pierre.

35. Appellants cite no authority, whether testimony from a person knowledgeable in the art, review articles, technical encyclopedias, or handbooks, in support of their characterizations of the teachings of Okamoto or St-Pierre.

36. Moreover, Appellants do not address the level of ordinary skill in the art, nor do they discuss what sorts of problems those of ordinary skill in the art are reasonably expected to be able to solve.

Rejections based on Ito

37. The Examiner finds that Ito teaches that "the nitrogen-enriched air from the oxygen-enriched air generating means (that includes an oxygen selective membrane) may be used to atomize liquid fuel (in this case, heavy oil, a carbon-containing feedstock). (* * * Col. 3, ll. 46-56)." (Final at 6.)

38. The Examiner reasons that because ordinary workers "would recognize the advantage in using an existing high(er)-pressure process stream to pressurize another process stream based [on] environmental, economic, and system efficiency factors," such workers would have used the low oxygen content stream to pressurize the liquid fuel stream in fuel processor sections of fuel cell systems, as in Appellants' claims 45, 48, 61, and other claims. (Final Rejection at 6, ¶ 8; 10–12, ¶ 12; and at 13, ¶ 13.)

39. With respect to claims 45, 48, and 61, Appellants argue that the Examiner's reliance on the combined teachings of Okamoto, St-Pierre, and Ito to reject claims 45, 48, and 61 is unsound because Ito does not teach the limitation common to those claims that "the byproduct stream produced from the oxygen-enrichment assembly is used to pressurize a supply of liquid fuel." (Brief at 13; emphasis original.)

40. In Appellants' words:

> Ito discloses using nitrogen-enriched (i.e., oxygen-depleted) air from an oxygen-enriched air generating means **8** for atomizing the fuel (e.g., heavy oil) delivered to the burner **2** and thus provide for better combustion. (Col. 3, line 44 – col. 4, line 42.) * * * Ito simply does not disclose pressuring a supply of fuel with the oxygen-depleted stream from an oxygen-enrichment assembly.

(Brief at 14.)

41. Appellants conclude that "Ito fails to disclose or suggest a byproduct stream produced from an oxygen-enrichment assembly for pressurizing a supply of liquid fuel as recited in claims 45, 48, and 61." (Brief at 14.)

42. For the same reasons, Appellants argue that the rejections of dependent claims 46, 49, and 62–68 are also unsound. (Brief at 15.)

43. Appellants cite no authority, whether testimony from a person knowledgeable in the art, review articles, technical encyclopedias, or handbooks, in support of their findings as to what Ito teaches.

44. Appellants do not argue that the Examiner has improperly combined the teachings allegedly found in Ito with the teachings of Okamoto and St-Pierre.

D. Principles of Law

On appeal, Appellants bear the burden of showing that the Examiner has failed to establish sufficient factual and legal bases for the rejections. "The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981) (citations omitted).

E. Discussion

Appellants do not dispute that Okamoto and St-Pierre fail to teach any feature recited in independent claims 1 and 27. Rather, Appellants argue that the combination of an oxygen-enrichment device based on an oxygen-selective membrane that requires a pressure of at least two atmospheres into Okamoto's disclosed (single) atmospheric pressure system would result in an inoperative device. (Brief at 6–7.) Appellants argue further that such a result indicates that the references "teach away" from the proposed combination, and that the Examiner's rejections based on Okamoto, St-Pierre, and additional references, should be reversed. (Brief at 11.)

We are not persuaded. Appellants have not provided any basis that makes plausible their implicit theory that one skilled in the art would have bodily incorporated an oxygen-selective membrane suggested by St-Pierre into the air delivery system of Okamoto without the paraphernalia needed to make the selective membrane work. It has long been recognized that such blind combinations are not the proper test of obviousness. *Keller*, 642 F.2d at 425, 208 USPQ at 881. To put it another way, Appellants have not come forward with any evidence that those of ordinary skill in the art would have read Okamoto and St-Pierre as narrowly as Appellants implicitly urge, i.e., as being so limited in their teachings that the variation of operating conditions would not have occurred to one of ordinary skill in the art. On the contrary, we find that the disclosures of Okamoto and St-Pierre indicate that the level of ordinary skill encompasses rather sophisticated fluid handling technology, e.g., steam-reforming of methanol (Okamoto at col. 2, ll. 48-50), and hydrogen gas purification using palladium "membranes" (*id.* at col. 3,

ll. 24–32). Persons capable of working in this area would thus have been familiar with constructing and operating devices that handle gases at high pressures and high temperatures. Moreover, in a passage cited by Appellants (Brief at 9), St-Pierre states:

> [i]ncreasing the concentration of the reactant in reformed fuel and/or air streams, that is, enrichment, has thus been considered in the art as a way of improving fuel cell performance. Several enrichment methods are commonly known that involve separating out a component from the reactant stream, including cryogenic, membrane, and pressure swing adsorption methods. . . . In a membrane method, component separation is achieved by passing the stream over the surface of a membrane that is selectively permeable to a component in the stream.

(St-Pierre at col. 2, ll. 55–66.) Thus, taking St-Pierre at face value, enriching the air stream for fuel cells using membrane technology and pressure swing adsorption methods —both of which are disclosed by Appellants as being useful modes of oxygen enrichment (Specification at 14–16)— have been considered in the fuel cell art. Moreover, it appears from St-Pierre that both technologies are well-established. On the present record, the weight of the evidence indicates that the ordinary worker in the fuel cell art would have adapted a well-established oxygen enrichment technology, such as oxygen-selective membranes or pressure swing adsorption, to a fuel cell system that relies on atmospheric oxygen, such as the one disclosed by Okamoto. Such a person would presumably have been familiar with the requirements of well-established technologies (or could readily learn them from the technical literature) and would have been able to make the necessary adaptations without requiring "undue experimentation." On the present record, we should require extremely persuasive testimony from an acknowledged and unbiased expert in the field that such was not the case. We accord no weight to mere arguments from counsel that fly in the face of reasonable readings of the record.

As for Appellants' objection that the Examiner did not mention limitations in a number of claims dependent on claims 1 and 27 (specifically, claims 2, 7–10, 20, 28, 29, 31, 33–35, 44, and 47), we observe that the Examiner expressly pointed out where the rejection identified several of the limitations, and that the Examiner asserted that the remaining limitations were also identified in the prior art relied on. (Answer at 2-3.) In their principal brief, Appellants did not specifically deny that Okamoto and St-Pierre teach the limitations recited in these dependent claims. Nor did Appellants clearly argue that these limitations would cause the claimed subject matter to be patentable over the combined teachings of Okamoto and St-Pierre due to unexpected results or other indicia of nonobviousness in the event that a prima facie case of obviousness of the independent claims had been established. Indeed, in their Reply brief, Appellants did not address the Examiner's Answer regarding the rejection of the dependent claims. Our review of the record indicates that the Examiner's representations as to the expressly identified limitations are accurate. In the absence of substantive argument from Appellants, we decline to undertake, sua sponte, a mission of fact-finding as to the teachings of Okamoto and an evaluation of whether those teachings provide an adequate basis for the findings and conclusions set out in the Examiner's Answer.

We conclude that Appellants have not shown reversible error by the Examiner in the rejection of claims 1, 27, and the associated dependent claims.

Appellants argue against the Examiner's rejection of independent claims 50 and 61 on the same basis, i.e., that the combination of Okamoto and St-Pierre teaches away from the claimed invention. (Brief at 11–13, Part I.D.) Appellants do not argue

separately the merits of claims dependent on claims 50 and 61. (Brief at 13, part I.E.) Rather, they argue that because the Examiner has failed to show that the independent claims are unpatentable, the dependent claims have not been shown to be unpatentable over the same references. For the reasons given immediately *supra*, we find these arguments unpersuasive.

Finally, Appellants argue that the rejection of claims 45, 48, 61, and claims dependent on them over the combined teachings of Okamoto, St-Pierre, and Ito, should be reversed because Ito does not teach that the byproduct stream produced from an oxygen-enrichment assembly is used "to pressurize a supply of liquid fuel." (Brief at 13-14.) Appellants do not direct our attention to any definition in the record of "pressurizing a supply of liquid fuel."

Our reviewing court has instructed that "the PTO applies to the verbiage of the claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant's specification." *In re Morris*, 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997). Appellants' specification teaches, "[f]or example, [nitrogen-enriched] stream 46 may be used to pressurize a supply of a liquid fuel, such as disclosed in U.S. Patent Application . . . ". (Specification at 14, ll. 16–21; emphasis added.) But, as perhaps Appellants recognized, whatever that application discloses (it has not been made of record in this appeal), it merely provides examples of

"pressurizing a supply of liquid fuel." It does not limit the meaning of the term in the present claims to any particular circumstance or mode

We take official notice, from items found in most households, that liquids are typically "atomized" by forcing them rapidly through an orifice under pressure. Although Ito does not describe exactly how the byproduct, low-oxygen, high-nitrogen content gas stream is used to atomize the liquid fuel, we can see from Ito Figure 4 that, as summarized by Appellants, the nitrogen-enriched stream is "delivered via pipe conduit **25** to the fuel spraying cylinder **20** of burner **2,** where it atomizes a fuel stream delivered via fuel supply pipe **4** to the fuel spraying cylinder **20**." (Brief at 14; Bold original.) The only reasonable interpretation on the present record is that the fuel is atomized by being forced at high speed, under pressure, through an orifice. The pressure, according to Ito, is provided by the byproduct gas from the oxygen enrichment means. On the present record, this fully meets the broadest reasonable interpretation of the limitation that the byproduct air stream is used to "pressurize a supply of liquid fuel."

Accordingly, we determine that Appellants have not borne their burden of demonstrating reversible error on the part of the Examiner with regard to the teachings of Ito.

F. ORDER

On consideration of the record and for the reasons given, the Examiner's rejections are AFFIRMED.

The Examiner's rejection of claims 1–3, 6, 7–10, 20, 27–29, 31, 33–35, 44, and 47 under 35 U.S.C. § 103(a) over the combined teachings of Okamoto and St-Pierre is AFFIRMED.

The Examiner's rejection of claims 13, 16, 50–58, and 60 under 35 U.S.C. § 103(a) over the combined teachings of Okamoto, St-Pierre, and Fuel Cell Systems is AFFIRMED.

The Examiner's rejection of claims 45, 46, 48, 49, 61–66, and 68 under 35 U.S.C. § 103(a) as being obvious over the combined teachings of Okamoto, St-Pierre, and Ito is AFFIRMED.

The Examiner's rejection of claim 19 under 35 U.S.C. § 103(a) over the combined teachings of Okamoto, St-Pierre, and Appleby is AFFIRMED.

The Examiner's rejection of claim 59 under 35 U.S.C. § 103(a) over the combined teachings of Okamoto, St-Pierre, Fuel Cell Systems, and Appleby is AFFIRMED.

The Examiner's rejection of claim 67 under 35 U.S.C. § 103(a) over the combined teachings of Okamoto, St-Pierre, Ito, and Appleby is AFFIRMED.

AFFIRMED

RICHARD E. SCHAFER)
Administrative Patent Judge)

ROMULO H. DELMENDO)
Administrative Patent Judge)

MARK NAGUMO)
Administrative Patent Judge)

MN/mg

KOLISCH HARTWELL, P.C.
200 PACIFIC BUILDING
520 SW YAMHILL STREET
PORTLAND OR 97204